

GROUNDWATER REMEDIATION PROJECT
TECHNICAL SPECIFICATIONS

PAGEL LANDFILL, ROCKFORD, ILLINOIS

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SECTION 01010 SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

The work shall include construction of an air sparging system which will deliver a regulated and monitored flow of 3 to 10 SCFM of dry clean compressed air at 30 psi to each of 31 injection wells. The work shall include construction of a soil vapor extraction system which will withdraw 50 SCFM of air from each of 13 extraction wells. The vacuum at each well head will be a minimum of 1 psi. The mechanical equipment for these systems shall be housed in a prefabricated steel building onsite.

The work shall include all labor, material, equipment and supplies required for the complete execution of all work in conjunction with construction of the air sparging and soil vapor extraction systems, as shown on the contract drawings, specified herein or as directed by the Engineer, and shall include, but not be limited to, the following:

- A. A survey of the site to locate and clearly mark building site trench, air sparging well, and soil vapor extraction well locations. The survey and mark the Site perimeter for the purpose of grubbing and erosion control.
- B. Installation of a concrete floor to support a prefabricated steel building and all compressors, regenerative blowers and appurtenances within the building.
- C. Two compressors, each providing 150 SCFM of compressed air at 125 psi. Included will be air filters, dryers, and oil removal as required, collectively called the compressed air system.
- D. Two regenerative blowers, each capable of a 280 SCFM flow rate of 3 psi vacuum, along with moisture separator, in-line air filter, vacuum relief valves, and appurtenances collectively called the vacuum extraction system.
- E. Provision of electrical power to compressors, regenerative blowers, heater, lights, and appurtenances.
- F. A process logic controller which will control interlocks between compressed air and vacuum extraction systems and all safety shutdowns.
- G. A heated and insulated prefabricated steel building for housing the compressed air and vacuum extraction systems.

- H. 750 feet of 3.5 feet deep by 3 feet wide trenching and backfilling of buried pipe for the compressed air manifold and the vacuum extraction piping.
- I. 750 feet each of compressed air manifold piping and vapor extraction manifold piping to well heads.
- J. Precast concrete well head enclosures at 13 extraction wells and 31 air sparging wells.
- K. Valves, regulators, flow meters, gauges, pressure relief valves, and piping for 13 extraction wells and 31 air injection wells.
- L. 13 vapor extraction wells averaging 40 to 50 feet deep.
- M. 31 air injection wells averaging 90 feet deep.

1.2 DEFINITIONS

Engineer:	Shall mean any authorized representative of GeoTrans, Inc.
Owner:	Shall mean any authorized representative of Winnebago.
Contractor:	Shall mean company or individual specified in the contract as responsible for the construction project.
Contract Documents:	Shall mean General Requirements, Technical Specifications, Construction Plans, Drawings, Instruction to Bidders, Contractor's Proposal, Subcontractor's Agreement, and any other written request and/or instructions from Engineer or Contract Addenda.
Site:	Shall mean the area on map designated as the construction area.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

- A. All work shall be done in a neat, workmanlike manner, and be carefully planned so that the interruption of existing operations are kept to a minimum.

- B. All work shall be completed under the direction of the Engineer. Any work not approved by the Engineer shall be replaced by the Contractor at no cost to the Owner or Engineer.

SECTION 01050 SITE SURVEY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall survey for the locations of the corners of the concrete floor for the prefabricated metal building. The location of all air sparging and vapor extraction wells shall be surveyed and clearly marked. The perimeter of the Site shall be surveyed and clearly marked. The trenching shall be surveyed, marked and the depth of pipe burial surveyed and verified by the Contractor. Vertical control is not necessary, all elevations are given from ground surface.
- B. The Contractor shall be responsible for the utility locations.

1.2 RELATED SECTIONS

- A. 02225 Trenching
- B. 02270 Erosion Control
- C. 02605 Well Head Enclosures
- D. 02610 Air Sparging Wells
- E. 02611 Soil Vapor Extraction Wells
- F. 03300 Concrete Floor for Prefabricated Building

1.3 REFERENCE DRAWINGS

- A. Drawing T-1 Title Page
- B. Drawing C-1 Piping Layout and Well Locations

1.4 SUBMITTALS

- A. The Contractor shall provide all notes from survey to the Engineer on a daily basis.
- B. The Contractor shall submit a site map with final locations of all wells, enclosures, buried piping, buried utilities, and equipment enclosure at the end of construction.

LIST OF DRAWINGS

DRAWING NUMBER	DRAWING NAME
C-1	PIPING LAYOUT AND WELL LOCATIONS
C-2	COMPRESSOR AND BLOWER PLAN AND PROFILE
E-1	ELECTRIC DIAGRAM
P-1	AIR INJECTION SYSTEM P&ID
P-2	SVE SYSTEM AND P&ID
M-1	PIPE MANIFOLD AND WELL HEAD DETAILS
M-2	WELL HEAD EXTRACTION AND INJECTION WELL HEAD DETAILS
M-3	COMPRESSOR AND BLOWER EQUIPMENT LAYOUT
T-1	SITE LOCATION MAP

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1.5 QUALITY ASSURANCE

- A. The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

The Contractor shall perform work in a timely manner. All work shall be protected. All survey stakes or markers that are disturbed during construction shall be resurveyed by the Contractor at the request of the Engineer. The cost of the resurveys shall be the responsibility of the Contractor. All survey work shall be checked at the request of the Engineer.

SECTION 02110 SITE CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

The Contractor shall clear and grub the site in preparation for construction of the building that will house the compressors and regenerative blowers, manifold trenching, and SVE and air sparging well installation. Area to be cleared and grubbed is as shown in the drawings.

1.2 RELATED SECTIONS

- A. 01050 Site Survey
- B. 02225 Trenching
- C. 02270 Erosion Control

1.3 REFERENCE DRAWINGS

Drawing C-1, Piping Layout and Well Locations

1.4 QUALITY ASSURANCE

- A. The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

- A. The Contractor shall remove all vegetation, shrubs, and trees and any other site surface conditions deemed by the Engineer to impede completion of the project.

B. Manufacturers Warranty

The Contractor shall provide a minimum 3-year manufacturers warranty on all equipment and products specified for this section.

1.5 MAINTENANCE

- A. The Contractor shall be responsible for maintenance and repair or replacement of all temporary erosion control structures which is damaged by weather, site construction activities or any other cause. This shall be as directed by the Engineer.
- B. The Contractor shall be responsible for maintenance and repair or replacement of all vegetation and permanent erosion control structures which are damaged by weather or any other cause. This shall be as directed by the Engineer.

1.6 QUALITY ASSURANCE

- A. The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. The Contractor shall seek products provided by a manufacturer specializing in the manufacture of the items specified in this section.
- C. The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 SILT FENCE

- A. Silt fence fabric shall be either woven or nonwoven:
 - 1. Woven fabric shall consist of silt films of polypropylene treated with ultraviolet light stabilizers.
 - 2. Nonwoven fabric shall consist of long chain polymeric filaments or polyester yarns.
 - 3. Silt fence fabric shall be inert to both chemicals commonly found in soils and hydrocarbons.

- B. Fence Post (for fabric units): The length shall be 32-inches minimum. Wood posts shall be of sound quality hardwood with a nominal cross sectional area of 2-by-2 inches. Steel posts shall be standard "T" and "U" sections weighing no less than 1.33 pounds per linear foot with a minimum length of 42-inches.
- C. Wire Fence (for fabric units): Wire fencing shall be a minimum 14-1/4 gage welded wire fabric with a maximum 6-inch mesh opening, or as approved by the Engineer.

2.2 EROSION MAT

- A. The erosion mat used for sediment control shall be made of natural material, synthetic material or a combination.
- B. The erosion control mat shall resist degradation for a 12 month period after installation regardless of material used.
- C. The erosion mat shall be capable of resisting shear stresses generated by water flowing across its upper surface of 0.4 psf.

2.3 STRAW BALES

Straw bales used for sediment control shall be made of tightly baled straw bound with at least two individual strands of poly-type twine. Bale dimensions shall be at least 1.5-feet by 2.5-feet long. Anchors for straw bales shall be wooden stakes that are a minimum of 1.5 by 1.5-inches by 3-feet in length.

2.4 SEED AND FERTILIZER

- A. The seed shall be labeled in accordance with USDA Rules and Regulations under the Federal Seed act and applicable State seed laws. Seed shall not have exceeded its expiration date.
- B. The seed mixture and fertilizer shall be appropriate for the area and shall be approved by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

Erosion control shall be approved by the Engineer. Additional controls shall be installed at the request of the Engineer. Seeding shall be in accordance with seed suppliers recommendations and approved by the Engineer.

- A. The Contractor shall provide silt fence at locations where drainages leave the work area and at any other location specified by the Engineer. Silt fence shall be installed according to manufacturer's recommendations. Silt fence shall be placed at least 5-feet down slope from the disturbed area. Silt fence shall be placed so that runoff cannot flow around the fence. Accumulated silt shall be removed by the Contractor as determined necessary by the Engineer.
- B. The Contractor shall place the erosion mat as specified by the Engineer within 48 hours of seeding operations. Erosion mat shall be placed and anchored according to manufacturer's instructions.
- C. The Contractor shall place straw in a single row length wise and perpendicular to channels, as directed by the Engineer. The base of the end bale shall be placed at a higher elevation than the top of the lowest bale in the channel.
- D. The Contractor shall apply seed by drill, at a rate recommended by the seed supplier, or as approved by the Engineer.

SECTION 02605 WELL HEAD ENCLOSURES

PART 1 - GENERAL

1.1 DESCRIPTION

The well head enclosures shall consist of precast concrete manholes with cast iron frame and covers. The manholes shall have a 4-foot internal diameter with 3-inch thick walls, and be 4-feet tall with the bottom 1-foot being filled with pipe bedding, as shown in the Drawings. The cover shall be flat topped with a 3-foot diameter cast manhole cover.

1.2 RELATED SECTIONS

- A. Section 02225 Trenching
- B. Section 02270 Erosion Control and Vegetation
- C. Section 02610 Air Sparging Wells
- D. Section 02611 Soil Vapor Extraction Wells
- E. Section 15063 Compressed Air Header Piping
- F. Section 15064 SVE Piping Manifold

1.3 REFERENCE DRAWINGS

- A. Drawing C-1, Piping Layout and Well Locations
- B. Drawing M-1, Pipe Manifold and Well Head Details
- C. Drawing M-2, Well Head Extraction and Injection Well Head Details

1.4 WARRANTY

- A. Special Warranty

The Contractor shall correct all defective work within a 1-year period of substantial completion.

B. Manufacturers Warranty

The Contractor shall provide 2-year manufacturer's warranty on all equipment and products specified for this section.

1.5 QUALITY ASSURANCE

- A.** The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B.** The Contractor shall seek products from a manufacturer specializing the manufacture of items specified in this section.
- C.** The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 WELL SCREEN

Well screen shall be Schedule 80 flush threaded PVC. A PVC end cap shall be provided and installed. Slots shall be 0.02 factory slots.

2.2 WELL CASE

Well case shall be Schedule 80 flush threaded PVC.

2.3 SAND PACK

Sand pack shall be 6 to 9 mesh washed silica sand.

2.4 BENTONITE SEAL

Bentonite seal shall consist of bentonite chips or pellets.

2.5 BENTONITE-CEMENT GROUT

Bentonite-cement grout shall be formulated in a grout mixer as determined by the Engineer, using dry bentonite and cement powder.

PART 3 - EXECUTION

The Engineer, or Engineer's representative, shall be present in the field when all boreholes are installed wells are constructed. Engineer, or Engineer's representative shall be responsible for field decisions regarding depth of wells and placement of screens.

The Contractor shall ensure that the bentonite seal is fully hydrated. Bentonite-Cement Grout shall be placed such that no voids will exist in the borehole between the formation and the well case. There shall be an air-tight seal formed between the formation and the well case.

The Contractor shall coordinate surface completion with construction of the air injection well heads in Section 15062. The Bentonite-Cement Grout shall not extend above the depth of the bottom of the well head enclosure, as shown on the Drawings.

SECTION 02611 SOIL VAPOR EXTRACTION WELLS

PART 1 - GENERAL

1.1 DESCRIPTION

The boreholes for the 13 soil vapor extraction wells shall be 8-inches in diameter. The depth will be determined by the Engineer in the field. In general, the boreholes will average between 30-and 40-feet deep. The well case and screens shall be schedule 80 threaded PVC. The depth of the screen shall be determined by the Engineer for each well as it is installed. The screen shall be threaded schedule 80 0.02-inch slotted PVC and a length specified in the field by the Engineer. The sand pack shall be a 10 mesh sand from the bottom of the screen to 1-foot above the screen. Two feet of hydrated bentonite seal shall be placed above the sand pack, and bentonite-cement grout shall be placed from the top of the bentonite seal to the depth of the bottom of the well head enclosure.

1.2 RELATED SECTIONS

- A. Section 02605 Well Head Enclosures
- B. Section 15061 Soil Vapor Extraction Well Heads
- C. Section 15064 SVE Piping Manifold

1.3 REFERENCE DRAWINGS

- A. Drawing C-1, Piping Layout and Well Locations
- B. Drawing C-2, Compressor and Blower Plan and Profile
- C. Drawing M-1, Pipe Manifold and Well Head Details
- D. Drawing M-2, Well Head Extraction and Injection Well Head Details

1.4 WARRANTY

- A. Special Warranty

The Contractor shall correct all defective work within a 1-year period of substantial completion.

B. Manufacturers Warranty

The Contractor shall provide 2-year manufacturer's warranty on all equipment and products specified for this section.

1.5 QUALITY ASSURANCE

- A. The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. The Contractor shall seek products from a manufacturer specializing the manufacture of items specified in this section.
- C. The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 WELL SCREEN

Well screen shall be Schedule 80 flush threaded PVC. A PVC end cap shall be provided and installed. Slots shall be 0.02 factory slots.

2.2 WELL CASE

Well case shall be Schedule 80 flush threaded PVC.

2.3 SAND PACK

Sand pack shall be 6 to 9 mesh washed silica sand.

2.4 BENTONITE SEAL

Bentonite seal shall consist of bentonite chips or pellets.

2.5 BENTONITE-CEMENT GROUT

Bentonite-cement grout shall be formulated in a grout mixer as determined by the Engineer, using dry bentonite and cement powder.

PART 3 - EXECUTION

The Engineer, or Engineer's representative, shall be present in the field when all boreholes are installed wells are constructed. Engineer, or Engineer's representative, shall be responsible for field decisions regarding depth of wells and placement of screens.

The Contractor shall ensure that the bentonite seal is fully hydrated. Bentonite-Cement Grout shall be placed such that no voids will exist in the borehole between the formation and the well case. There shall be an air-tight seal formed between the formation and the well case.

The Contractor shall surface completion with construction of the soil vapor extraction well heads in Section 15061. The Bentonite-Cement Grout shall not extend above the depth of the bottom of the well head enclosure, as shown on the Drawings.

SECTION 03300
CONCRETE FLOOR FOR PREFABRICATED BUILDING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Cast in place, reinforced concrete floor will structurally support all equipment, including two screw compressors, two regenerative blowers, GAC tanks and other appurtenances. It will also support the prefabricated steel building. The building will have three foot aprons in front of all doors. These aprons should drain away from the building. Contractor will be responsible for all site preparations, including surveying building locations, grade preparation, and form work. Over-sized Schedule 80 PVC piping will be used to sleeve the piping penetrations.
- B. The work shall include at a minimum the following:
 - 1. Cast-in-place (CIP) concrete for one 12- to 18-inch-thick slab-on-grade.
 - 2. Formwork for CIP concrete, with shoring, bracing, anchorage, openings for other affected work, form accessories, and stripping forms.
 - 3. Reinforcing steel bars (Number 5 rebar).
 - 4. Finishing of concrete slab. Concrete hardener, sealer, slip-resistant coatings.
 - 5. Expansion and contraction, control joints in CIP concrete.
 - 6. Concrete curing and protection.

1.2 RELATED SECTIONS

- A. Section 01050 Site Survey
- B. Section 02110 Site Clearing
- C. Section 02223 Pipe Bedding and Backfilling
- D. Section 02225 Trenching and Excavation
- E. Section 13122 Prefabricated Building

- F. Section 15054 Air Compressors and Appurtenances
- G. Section 15055 Soil Vapor Extraction Blowers
- H. Section 15056 Activated Carbon

1.3 REFERENCE DRAWINGS

- A. Drawing C-1, Piping Layout and Well Locations
- B. Drawing C-2, Compressor and Blower Plan and Profile
- C. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 REFERENCES

- A. The following standards establish acceptable and required construction practices for this project.
 - 1. Building Code of the City.
 - 2. Applicable County Codes and Requirements.
 - 3. State of Illinois Building Code.
 - 4. ACI 318-89 "Building Code Requirements for Reinforced Concrete."
 - 5. ACI "Manual of Concrete Practice" latest issue and reference standards included therein and listed in ACI 301 par 1.5, establish good and acceptable practice for CIP concrete construction.
 - 6. ACI 121R-85 "Quality Assurance Systems for Concrete Construction."
 - 7. ACI 347-78 (Reaffirmed 1984) "Recommended Practice for Concrete Formwork."
 - 8. ACI 117-88 Standard: "Standard Tolerances for Concrete Construction and Materials" except as modified by requirements specified herein.
 - 9. National Ready Mix Concrete Association (NRMCA) "Quality Control Manual," 1984, Sections 1, 2, and 3.
 - 10. ASTM C94-84 Standard Spec. for Ready Mixed Concrete.

1.5 SUBMITTALS

Contractor shall submit a reinforcement plan for the concrete floor to the Engineer, before commencement of work.

1.6 WARRANTY

A. Installation Warranty

Correct all defective work within a 1-year period of substantial completion.

B. Manufacturers Warranty

Provide minimum 2-year manufacturers warranty on all equipment and products specified for this section.

1.7 QUALITY ASSURANCE

A. **Installer Qualifications:** Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. **Manufacturer Qualifications:** Products will be provided by a manufacturer specializing the manufacture of items specified in this section.

C. Comply with pertinent codes and regulations of governmental agencies having jurisdiction.

D. All materials, equipment, and methods shall be subject to verification inspections and/or testing as specified by the Engineer.

PART 2 - PRODUCTS

2.1 CONCRETE

A. Description

1. All concrete unless otherwise noted shall have a compressive strength of 4,000 psi at the end of 28 days and conform to ACI 301, Section 2.1

2. Portland Cement: ASTM C150-80 - Type I unless otherwise approved.

3. The Contractor shall assume full responsibility for the quality and soundness of cement. Cement is to be of one type and from the same mill; it is to be of uniform color for all concrete with permanently exposed concrete finishes.
4. Admixtures: Conform to ACI 301, Sections 2.2 and 3.7, and ACI 212.2R-81 - Admixtures must be approved by the Engineer in writing prior to use or are required as specified herein and are to be used in strict accordance with the manufacturer's specifications or recommendations.
5. Aggregates: Conform to ACI 301, Section 2.4 and ACI 221R
6. Concrete shall conform to the limits of deleterious substances and physical properties of Table 3, ASTM C33.
7. Local aggregates: Local aggregates not complying with ASTM C33 but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Engineer.
8. Maximum size of coarse aggregate: ACI 301, Section 3.6.
9. Water: Meet requirements of ASTM C94.

B. Manufacturer

Manufacturer shall be pre-approved by the Engineer.

2.2 FORMWORK

Conform to ACI 301, Chapter 4 Formwork and ACI 347-88 "Guide to Formwork for Concrete;" (SP-4), 5th Edition, 1989, Formwork for Concrete.

- A. Design and construct formwork to meet design and code requirements so that the resultant concrete conforms to required shapes, lines, and dimensions. Performance of the formwork is the responsibility of the Contractor (ACI 301 Section 4.2 and ACI 347-88, Chapters 2 and 3).
- B. Form Materials for Structural Concrete: (Surfaces covered with other finishes - not exposed to view after completion of project)

1. Wood form materials:
 - a. Plywood: Moisture-resistant, concrete form plywood commercial standard Exterior grade, edges sealed.
 - b. Lumber: No. 2 dressed lumber; Southern yellow pine, white pine, or Douglas fir.
 - c. Nails, spikes, lag bolts, thru bolts, ties and anchorages: Sized as required and of sufficient strength and character to maintain formwork in place while pouring concrete.
2. Prefabricated forms:
 - a. Steel type or fibrous glass-reinforced resin type: Well-matched, tight-fitting, and stiffened to support weight of concrete without deflection detrimental to tolerance allowed.

2.3 REINFORCEMENT MATERIALS

ACI 301, Section 5.2

- A. General: All reinforcement steel shall be Grade 60 deformed billet steel conforming to ASTM A615. Detail all reinforcing steel in accordance with ACI Detailing Manual, latest edition. Reinforcing steel shall be supported with metal chains or hung from forms. Concrete, bricks, blocks, etc., shall not be used.
- B. Splices: No splices of reinforcement shall be made except where shown on the design drawings, or as specified, or as authorized by the Engineer. All lap splices shall conform to the requirements of ACI 318. No. 5 bars shall be lapped 2'0" at splice. Welded splices or other positive connections may be used instead of splices. However, if welded splices are used, the bars will be welded so that they develop at least 125 percent of the specified yield strength of the reinforcing bar.
- C. Minimum Cover: The reinforcement of footings and other principal structural members in which the concrete is deposited against the ground shall have not less than three (3) inches of concrete between it and the ground contact surface unless noted on the drawings.
- D. Bending: All bars shall be bent cold. No bars partially embedded in concrete shall be field-bent. Bends and all bars shall have a diameter on the inside of the bar not less than the value given below:

Bar Size	Minimum Diameter
#3 thru #8	6"
#9, #10, #11	8"

PART 3 - EXECUTION

3.1 GENERAL

Install all CIP concrete work in accordance with ACI 301 except as herein specified.

3.2 PREPARATION

A. Foundation treatment required:

1. Excavated 36 inches of soil.
2. Compact excavated surface to 95 percent of standard proctor density.
3. Place and compact sand backfill to 95 percent of standard proctor density to bring to grade.

3.3 FORMWORK

ACI 301, Chapter 4 and ACI 347

A. Formwork erection:

1. Design and construct formwork to meet design and code requirements so that resultant finished concrete conforms to required shapes, lines, and dimensions.
2. Provide bracing to ensure stability of formwork including provision for construction loads.
3. Preparation of formed surfaces: ACI 301, Section 4.4
 - a. When elected by the Contractor, an approved form release agent may be used in accordance with manufacturer's recommendations. Soak inside surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

- b. Construction joints: Conform to ACI 301 paragraph 6.1
 - c. Field quality control:
4. The Contractor is to inspect and check completed formwork and bracing to ensure that work is in accordance with formwork design.

3.4 REINFORCEMENT

A. Placement: ACI 301, Section 5.5

- 1. Place reinforcing, supported and secured against displacement, as indicated on Contractor's approved rebar placing drawings.
- 2. Reinforcing placement shall be inspected and approved by the Engineer before placement of concrete.

3.5 CONCRETE CONVEYING AND DEPOSITING

The Contractor shall have a qualified person available and responsible for receiving and monitoring concrete received from Ready-Mix supplier.

A. Placement: Conform to ACI 301, Chapter 8

- 1. Notify the Engineer a minimum of 72 hours prior to commencement of concreting operations.
- 2. Ensure that reinforcement, inserts, embedded parts, and formed expansion and contraction joints are not disturbed during concrete placement.
- 3. Consolidation of concrete: ACI 309-72 (78).

B. Depositing concrete: Conform to ACI 301, Section 8.3 and ACI 304-73.

- 1. Pour concrete continuously between predetermined approved construction and control joints. Do not break or interrupt successive pours such that cold joints occur. Pour concrete to conform to SVE and Compressed Air piping penetrations.
- 2. Conform to ACI 305 R-77 when concreting during hot weather.
- 3. Conform to ACI 306 R-78 when concreting during cold weather.

C. Repair of surface defects: ACI 301, Chapter 9 and Section 13.6.

1. Inspect concrete surfaces immediately upon removal of forms. Patch imperfections as needed or as directed by the Engineer.
2. Modify or replace concrete not conforming to required lines, details, and elevations.
3. Repair or replace concrete with excessive honeycombing and other defects due to improper placement. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of the Engineer for each individual area.

3.6 FINISHING

A. Finishing of formed surfaces: ACI 301, Chapter 10.

1. Finish as recommended for standard indoor or outdoor industrial use.

3.7 CURING AND PROTECTION

ACI 301, Chapter 12 and ACI 308-81.

SECTION 13122 PREFABRICATED BUILDING

PART 1 - GENERAL

1.1 DESCRIPTION

A prefabricated metal building shall be erected on the concrete floor to house the two screw air compressors and the two regenerative blowers and appurtenances. The building will be divided into two halves, with a vapor sealed wall divider between the sides. The building will have an access door and a overhead door on each side of the building, as shown in the drawings. The building will also have heating and lighting fixtures. All equipment within the half of the building containing the SVE equipment will be explosion proof.

The building shall contain a pre-engineered, shop fabricated, structural steel building frame. This frame will be erected on and structurally attached to the concrete floor. The building siding and roofing will be pre-finished steel panels. The building shall have one steel access door and door frame and one overhead door for equipment access. This door shall have a dead bolt type lock. The building shall have steel rain gutters and down spouts adequate to divert rainfall away from the structure. The building shall have air inlet and outlet louvers on the compressor side of the building. There shall be a fan on the outlet louvers which has an air flow capacity equal to or exceeding the combined capacities of the air fans on the radiators of the air cooled compressors and the refrigeration air dryers. The area of the louvers shall handle the capacity of the fan.

1.2 RELATED SECTIONS

- A. Section 02110 Site Clearing
- B. Section 02225 Trenching and Excavation
- C. Section 02223 Pipe Bedding and Backfilling
- D. Section 03300 Concrete Floor for Prefabricated Building

1.3 REFERENCE DRAWINGS

- A. Drawing C-1, Piping Layout and Well Locations
- B. Drawing C-2, Compressor and Blower Plan and Profile
- C. Drawing E-1, Electric Diagram

D. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 REFERENCES

American Institute of Steel Construction S335-89, Specifications for Structural Steel Buildings

1.5 SUBMITTALS

The Contractor shall submit the following for approval prior to installation of the prefabricated building.

- A. Manufacturers shop drawings, including all materials, dimensions, finishes anchorages, fastenings, closures, sealants, and accessories. The Contractor shall indicate framing anchor bolt settings, sizes, and locations from foundation loads.
- B. The Contractor shall submit manufacturers data on pre-finished sheet-metal items and accessories.
- C. The Contractor shall submit manufacturers installation instructions for the building and all accessories.

1.6 WARRANTY

- A. Special Warranty

The Contractor shall correct all defective work within a 1-year period of substantial completion.

- B. Manufacturers Warranty

The Contractor shall provide a minimum 2-year manufacturer's warranty on all equipment and products specified for this section.

1.7 MAINTENANCE

- A. The Contractor shall provide all maintenance required for startup and operation of equipment installed under this section.
- B. The Contractor shall provide manufacturer's recommended maintenance schedule for all equipment installed under this section.

- C. The Contractor shall provide all maintenance materials, including routinely required spare parts, as recommended by the manufacturer for all equipment installed under this section.

1.8 QUALITY ASSURANCE

- A. The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B. The Contractor shall seek products from a manufacturer specializing the manufacture of items specified in this section.
- C. The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 METAL BUILDING

The metal building shall be 15-feet by 30-feet with a minimum interior ceiling height of 8-feet. The building will have two 3-foot wide personnel access doors as well as two 12-foot wide by 9-foot high equipment access doors as shown on the Drawings. The building shall be bisected by an interior wall which shall be an effective vapor barrier.

The building weatherproof and capable of withstanding all wind, snow and other loadings that may occur over the life of the project.

The building shall have rain gutters and down spouts to divert rainwater and snow melt away from the building.

2.2 INSULATION

Insulation of the roof shall be R-30 attached on interior roof panels. Insulation for walls shall be R-19 and attached to interior wall panels. Insulation shall be resistant to moisture.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Building shall be constructed in accordance with all materials submitted for part 1.5 of this section.

- B. All construction shall be plumb and level, as approved by the Engineer.
- C. Building shall be weather tight upon completion.
- D. All doors and other accessories shall be in good working order and operate smoothly as approved by the Engineer.

SECTION 15054 AIR COMPRESSOR AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

Two air cooled rotary screw air compressors in parallel shall be capable of providing 350 SCFM of compressed air at 125 psi. The air provided by the compressors shall be oil and moisture free. The air compressors shall be followed by air dryers, which will both dry and cool the air and a series of air filters, which shall remove traces of compressor oil down to 0.05 ppm by volume. The Contractor shall furnish piping and any other appurtenances recommended by the manufacturer or Engineer. The compressor shall be controlled to provide the required flow of air to the compressed air manifold by demand. The compressors shall be located in the prefabricated metal building.

1.2 RELATED SECTIONS

- A. Section 03300 Concrete Floor for Prefabricated Building
- B. Section 13122 Prefabricated Building
- C. Section 15063 Compressed Air Header Piping

1.3 REFERENCE DRAWINGS

- A. Drawing C-2, Compressor and Blower Plan and Profile
- B. Drawing E-1, Electric Diagram
- C. Drawing P-1, Air Injection System P&ID
- D. Drawing M-1, Pipe Manifold and Well Head Details
- E. Drawing M-2, Well Head Extraction and Injection Well Head Details
- F. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 SUBMITTALS

All manufacturer's O&M manuals, literature, and shop drawings shall be submitted to the Engineer for approval prior to installation of equipment listed in Section 2.

- C. The Contractor shall install the compressors and appurtenances according to the recommendations of the manufacturer and Engineer.
- D. The Contractor shall install the piping to contain sufficient unions to allow for the removal of individual pieces of equipment.
- E. The Contractor shall install the equipment install such that air circulation is not restricted and the equipment is allowed to adequately cool.

3.2 DEMONSTRATION

The contractor shall demonstrate that the system is functioning. The demonstration shall include operation of all safety interlocks. Demonstration shall include uninterrupted operation for a period of five days.

SECTION 15055 SVE BLOWERS AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

Two regenerative blowers operating in parallel shall provide a total of 560 SCFM flow rate under 100-inches of H2O vacuum at the blower inlet. The blowers shall be at minimum 15 HP each, explosion proof, rated for Class I Group D atmospheres, and shall include particulate filters, a moisture separator, a vacuum relief valve, and other appurtenances recommended by the manufacturer or Engineer. The system shall have safety shutoffs and interlocks such that it can operate unattended 24 hours per day for the life of the project. Any system malfunction shall shut down the system without harm to the system.

1.2 RELATED SECTIONS

- A. Section 03300 Concrete Floor for Prefabricated Building
- B. Section 13122 Prefabricated Building
- C. Section 15056 Activated Carbon
- D. Section 15064 SVE Piping Manifold

1.3 REFERENCE DRAWINGS

- A. Drawing E-1, Electric Diagram
- B. Drawing P-2, SVE System and P&ID
- C. Drawing M-1, Pipe Manifold and Well Head Details
- D. Drawing M-2, Well Head Extraction and Injection Well Head Details
- E. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 SUBMITTALS

All manufacturer's O&M manuals, literature, and shop drawings shall be submitted to the Engineer for approval prior to installation of equipment listed in Section 2.

1.5 WARRANTY

A. Installation Warranty

The Contractor shall correct all defective work within a 1-year period of substantial completion.

B. Manufacturers Warranty

The Contractor shall provide a minimum of 2-year manufacturer's warranty on all equipment and products specified for this section.

1.6 MAINTENANCE

Upon startup of the SVE and Air Sparging systems, the Contractor shall:

- A.** Provide all maintenance required for startup and operation of equipment installed under this section.
- B.** Provide manufacturer's recommended maintenance schedule for all equipment installed under this section.
- C.** Provide all maintenance materials, including routinely required spare parts, as recommended by the manufacturer for all equipment installed under this section.

1.7 QUALITY ASSURANCE

- A.** The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B.** The Contractor shall seek products from a manufacturer specializing the manufacture of items specified in this section.
- C.** The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 REGENERATIVE BLOWERS

- A. The regenerative blowers shall be EG&G Model EN 909 Regenerative Blowers, or equivalent as approved by the Engineer. The regenerative blowers shall be explosion proof, rated for Class I Group D atmospheres, and capable of producing a flow rate of 280 SCFM at 100 inches of water vacuum. The construction shall be cast aluminum housing, cover, impeller, and manifold, and cast iron flanges. The inlet and outlets shall have a minimum of 3-inch diameter NPT fittings. The regenerative blowers shall have thermal protection.
- B. Manufacturer
EG&G Rotron
Gast

2.2 RELIEF VALVE

- A. The relief valve is installed to prevent excessive system vacuum. The relief valve shall be a EG&G Rotron Part Number 519093 or equal as approved by the Engineer. This will be installed directly upstream of the blower, as shown in the Drawings. The relief valve shall have a cast iron body, a steel valve spring and a nitrile diaphragm. The inlet shall be a 2-inch NPT.
- B. Manufacturers
EG&G Rotron
Gast

2.3 MOISTURE SEPARATOR

- A. The moisture separators shall be an EG&G Rotron Model MS350B or equal as approved by the Engineer. The moisture separator shall be designed to operate at a 280 SCFM flow rate with less than 6-inches of water head loss. The moisture separator shall incorporate cyclonic separation to remove entrained water. The moisture separator must protect against overflow by fail safe mechanical means. An electrical switch or contacts alone is not an acceptable means of protection against overflow. The inlet shall be tangentially located and welded to the body. The water reservoir shall have a minimum of 40 gallons of storage capacity.
- B. Manufacturers
EG&G Rotron
Gast

2.4 PARTICLE FILTERS

- A. The particle filter shall precede the blower air inlet. It shall have 4-inch NPT pipe connections at the inlet and outlet. The particle filter shall have a minimum of 97 percent removal efficiency for particles in the 8 to 10 micron size range.
- B. Manufacturers
EG&G Rotron
Gast

2.5 VACUUM GAUGES

- A. The vacuum gauges should be Bourdon tube type with a 0 to 30 inches of mercury range.
- B. Manufactures
Omega

2.6 VALVES

- A. All valves shall be true union PVC globe valves.
- B. Manufacturers
Plast-o-matic
ASAHI

2.7 PIPING

All piping shall be Schedule 80 PVC tubing in the appropriate diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

The Contractor shall install all equipment in the building as shown in the Drawings. Equipment will be anchored to the concrete floor as appropriate. Piping and appurtenances will be supported as required and approved by the Engineer. Supports shall allow flexibility in the piping to allow the piping to compensate for thermal and pressure expansion without harm to the system. The system shall be installed to operate vibration free, or have vibration isolating connections in piping and supports as required. All piping will be solvent welded and pressure checked as appropriate.

3.2 DEMONSTRATION

The contractor shall demonstrate that the system is functioning. The demonstration shall include operation of all safety interlocks. Demonstration shall include uninterrupted operation for a period of 5 days.

SECTION 15056 ACTIVATED CARBON

PART 1 - GENERAL

1.1 DESCRIPTION

The contractor shall furnish, and operationally test 2 vapor-phase granular activated carbon (GAC) units and all associated equipment. The adsorption systems shall be designed for the removal of chemical parameters from vapor-phase gases volatilized by the air sparging system. A single manufacture shall supply all the equipment described in the Section. The manufacture shall supply, deliver, and load the GAC to be used by the system.

1.2 RELATED SECTIONS

- A. Section 15055 Soil Vapor Extraction Blowers
- B. Section 15064 Soil Vapor Extraction Piping Manifold

1.3 REFERENCE DRAWINGS

- A. Drawing C-2 - Compressor and Blower Plan and Profile
- B. Drawing P-1 - Air Injection System P&ID
- C. Drawing P-2 - SVE System and P&ID

1.4 REFERENCES

ASME Code for Unfired Pressure Vessels

1.5 SUBMITTALS

All manufacturers O&M manuals, literature, and shop drawings shall be submitted to the Engineer for approval prior to installation of equipment listed in Section 2.

1.6 WARRANTY

- A. Special Warranty

The GAC contractor manufacturer shall warrant the process to be capable of achieving the desired effluent levels, as specified by the Engineer. If the system

installed does not achieve the desired effluent, the manufacturer shall make whatever adjustments and modifications to the system necessary to achieve the designed effluent at manufacturer's own expense.

B. Manufactures Warranty

The GAC contractor manufacturer shall warrant the units supplied to the Owner against defects in workmanship and material for a period of 2 years form the date of acceptance of the project by the Engineer.

1.7 MAINTENANCE

Upon startup of the SVE and Air Sparging systems, the Contractor shall:

- A. Provide all maintenance required for startup and operation of equipment installed under this section.
- B. Provide manufactures recommended maintenance schedule for all equipment installed under this section.
- C. Provide all maintenance materials, including routinely required space parts, as recommended by the manufacturer for all equipment installed under this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Vapor-phase GAC Contractors
 - 1. The manufacturer shall determine the type of vapor-phase GAC media to be supplied to achieve the performance requirements.
 - 2. Manufacture shall provide 2-vapor-phase GAC media contractors to treat the sparging off gases.
 - 3. Each contractor shall have a minimum airflow capacity of 560 SCFM.
 - 4. The contractors shall consist of a stainless-steel screen with fiberglass support structure. The screen shall be capable of supporting up to 2000 lbs of vapor-phase GAC. The system shall have 2 fork lift channels.
 - 5. Contractors shall have internal air distribution system at both inlet and outlet to minimize channeling.

6. Contractors shall have nominal 6-in. inlet connections and nominal 6-in. discharge connections with a 3/4 in. drain.
7. Humidity control shall be provided as part of the off-gas ducting to the contractors to maximize the GAC media life.

B. GAC Media

1. Supplier shall be able to supply virgin grade GAC and verify the quality of such material with analysis of all shipments.
2. The performance criteria shall be evaluated based on samples of the proposed material submitted to the Engineer in the form of laboratory reports. Failure of samples to meet the performance criteria shall result in rejection of the GAC media and removal and replacement of any installed materials, at no cost to the Owner.
3. Vapor-phase GAC materials Specifications

<u>Parameter</u>	<u>Value</u>
Material base	Coconut shell
Particle Size Distribution	4 by 8
Surface area	1175 m ² /gm
Iodine No.	1100
CTC, WT. %	60
Retentivity, WT. %	35
Ash (water soluble)	2%
Hardness	99
Abrasion No.	99
Moisture (maximum)	2%

C. Acceptable Manufacturers

1. The vapor-phase GAC contractors shall be manufactured by Carbon air Services or equivalent, subject to approval by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The GAC shall be installed at the job-site by the supplier's technical service staff. The GAC media supplied shall meet minimum standards regarding material specifications and physical properties.
- B. Materials shall be handled to keep them clean and undamaged during placement, and any materials becoming dirty or damaged shall be removed and replaced.

3.2 DEMONSTRATION

- A. After completion of installation, the equipment shall be inspected and certified by a representative of the manufacturer as being in compliance with manufacturer's recommendations and requirements. After such inspection, the equipment shall be adjusted by the manufacturer's representative and, when complete, the various items of equipment shall be placed into operation under the supervision of the manufacturer's representative, and in accordance with a schedule properly coordinated with the Engineer.
- B. The Contractor shall include 1 site visit by the manufacturer's field representative during the first year of operation to ensure proper operation and make adjustments as processing parameters change.

SECTION 15061 SVE WELL HEAD EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

The thirteen SVE well heads shall regulate the flow from the SVE wells to the SVE manifold. Each well head shall include a vacuum regulator, an adapter to allow the use of a pilot tube type flow meter, vacuum gauges, a flow metering valve, and any other appurtenances recommended by the manufacturer or Engineer which together will allow a precisely-controlled flow of air to be extracted from the subsurface. The well heads shall be installed as shown on the Drawings.

1.2 RELATED SECTIONS

- A. Section 02223 Pipe Bedding and Backfilling
- B. Section 02225 Trenching and Excavation
- C. Section 02605 Well Head Enclosures
- D. Section 02611 Soil Vapor Extraction Wells
- E. Section 15064 SVE Piping Manifold

1.3 REFERENCE DRAWINGS

- A. Drawing C-1, Piping Layout and Well Locations
- B. Drawing P-2, SVE System and P&ID
- C. Drawing M-1, Pipe Manifold and Well Head Details
- D. Drawing M-2, Well Head Extraction and Injection Well Head Details

1.4 SUBMITTALS

All manufacturer's O&M manuals, literature, and shop drawings shall be submitted to the Engineer for approval prior to installation of equipment listed in Section 2.

1.5 WARRANTY

A. Installation Warranty

The Contractor shall correct all defective work within a 1-year period of substantial completion.

B. Manufacturers Warranty

The Contractor shall provide a minimum of a 2-year manufacturer's warranty on all equipment and products specified for this section.

1.6 MAINTENANCE

Upon startup of the SVE and Air Sparging systems, the Contractor shall:

- A.** Provide all maintenance required for startup and operation of equipment installed under this section.
- B.** Provide manufacturer's recommended maintenance schedule for all equipment installed under this section.
- C.** Provide all maintenance materials, including routinely required spare parts, as recommended by the manufacturer for all equipment installed under this section.

1.7 QUALITY ASSURANCE

- A.** The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B.** The Contractor shall see products from a manufacturer specializing the manufacture of items specified in this section.
- C.** The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 VACUUM REGULATOR

The vacuum regulator will have a adjustable vacuum range of 1 to 10 psi and have a minimal head loss at flows up to 50 SCFM of air at 1 psi of vacuum and a vacuum source of 3 psi maximum. Fitting shall be a minimum of 1-inch NPT. Regulators shall be approved by the engineer.

2.2 VACUUM GAUGES

- A. The vacuum gauges shall have ranges of 0- to 30-inches if mercury vacuum. These shall be Bourdon tube type gauges with a minimum accuracy of 4 percent of full scale.
- B. Acceptable Manufacturers
Omega

2.3 VALVES

- A. The valves shall be 2-inches PVC butterfly valves.
- B. Acceptable Manufacturers

Plast-o-matic
ASAHI

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall install the equipment so that all gauges, regulators, flow meter adapters, and valves can be observed and/or operated from the opening in the enclosure.
- B. The Contractor shall install sufficient pipe unions to allow easy removal of the equipment from the well enclosure.
- C. The Contractor shall take care to insure dirt or debris does not enter the SVE manifold during construction activities.
- D. The Contractor shall ensure that all PVC pipe shall be threaded or solvent welded.

3.2 DEMONSTRATION

The contractor shall demonstrate that the system is functioning. The demonstration shall include operation of all safety interlocks. Demonstration shall include uninterrupted operation for a period of 5 days. The SVE wells heads shall be free of leaks and function to the satisfaction of the Engineer.

SECTION 15062 AIR INJECTION WELL HEADS

PART 1 - GENERAL

1.1 DESCRIPTION

The air injection well heads shall regulate a 0 to 10 SCFM flow of air from the compressed air manifold to the air injection wells. There will be one air injection well head for each injection well, or a total of 31. The well head equipment will consist of piping, a pressure regulator, a flow meter, a flow regulating valve, a pressure relief valve, and three pressure gauges as described in the drawings. The system will regulate the air pressure from the 60 to 100 psi in the manifold to 20 to 30 psi. A valve will meter the flow, which is measured with the in-line flow meter. A pressure relief valve will insure that the well heads are not over-pressured.

1.2 RELATED SECTIONS

- A. Section 02605 Well Head Enclosures
- B. Section 02610 Air Sparging Wells
- C. Section 15063 Compressed Air Header Piping

1.3 REFERENCE DRAWINGS

- A. Drawing C-1, Piping Layout and Well Locations
- B. Drawing P-1, Air Injection System P&ID
- C. Drawing M-1, Pipe Manifold and Well Head Details
- D. Drawing M-2, Well Head Extraction and Injection Well Head Details
- E. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 SUBMITTALS

All manufacturer's O&M manuals, literature, and shop drawings shall be submitted to the Engineer for approval prior to installation of equipment listed in Section 2.

1.5 WARRANTY

A. Installation Warranty

The Contractor shall correct all defective work within a 1-year period of substantial completion.

B. Manufacturers Warranty

The Contractor shall provide a minimum of a 2-year manufacturer's warranty on all equipment and products specified for this section.

1.6 MAINTENANCE

Upon startup of the SVE and Air Sparging systems, the Contractor shall:

- A.** Provide all maintenance required for startup and operation of equipment installed under this section.
- B.** Provide manufacturer's recommended maintenance schedule for all equipment installed under this section.
- C.** Provide all maintenance materials, including routinely required spare parts, as recommended by the manufacturer for all equipment installed under this section.

1.7 QUALITY ASSURANCE

- A.** The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B.** The Contractor shall seek products from a manufacturer specializing the manufacture of items specified in this section.
- C.** The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 PRESSURE REGULATORS

All regulators shall be Speedaire Heavy-Duty Air Line Regulators, or equivalent as approved by the Engineer. Regulators shall be of the diaphragm type. Regulators shall have a 2 to 125 PSI adjustable output pressure. Regulator shall have 1/4-inch NPT threaded fittings for upstream and downstream pressure gauges. Regulators shall have a flow rating of 140 CFM. Regulators will have a maximum upstream pressure rating of 250 psi.

2.2 VALVES

Valves shall be a NIBCO Class 125 Bronze Gate valves, or equal as approved by the Engineer. Valves shall be of a non-corrosive material. Valves shall have a pressure rating of 200 psi. Valves shall have less than 1 psi pressure drop with a 20 SCFM flow at 30 psi, when wide open.

2.3 FLOW METERS

The Flowmeters shall be Omega Model FL2724B Pneumatic In-Line Flowmeters or equivalent as approved by the Engineer. Flow meters shall have a 4 to 24 SCFM flow range at 100 PSI. Flowmeters shall have a 300 PSI or greater pressure rating. Flowmeters shall be constructed of a noncorrosive material.

2.4 PRESSURE RELIEF VALVES

The Pressure Relief Valves shall be Speedaire or equivalent as approved by the Engineer. Pressure relief valves shall be adjustable to a 50 psi setting and have a flow rate of 35 SCFM at the set pressure rating. Pressure relief valves shall be constructed of a noncorrosive material.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall install the system shall as shown in the Drawings.
- B. The Contractor shall ensure that all gauges, meters and controls are readable, accessible, and adjustable from outside the vault. It should not be necessary to enter the vault to monitor or control the system.
- C. The Contractor shall set the pressure relief valve at 50 psi.

- D. The Contractor shall use adequate pipe unions to allow for removal of the mechanical equipment from the well head enclosure with minimum effort.
- E. The Contractor shall use an adequate supports to hold the mechanical equipment firmly in place so it may be operated with one hand. The supports must have enough flexibility to allow room for thermal expansion of the compressed air header piping.
- F. The Contractor shall install strait run of pipe a minimum of 15 pipe diameters in length before the flow meter and a straight run of pipe minimally 5 pipe diameters in length shall be installed after the flow meter.

3.2 DEMONSTRATION

The contractor shall demonstrate that the system is functioning. The demonstration shall include operation at flow ranges of 3 to 10 SCFM and at pressures from 20 to 40 psi. Demonstration shall include uninterrupted operation for a period of 5 days.

SECTION 15063 COMPRESSED AIR HEADER PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

Provide approximately 750 feet of air header piping and fittings to provide a 10 SCFM flow of 125 psi air from the two compressors in the equipment building to each of 31 injection wells, as shown on Drawings and as described below. All piping will be buried according to Drawings and Specifications.

1.2 RELATED SECTIONS

- A. Section 02223 Pipe Bedding and Backfilling
- B. Section 02225 Trenching and Excavation
- C. Section 02605 Well Head Enclosures
- D. Section 15062 Air Injection Well Heads

1.3 REFERENCE DRAWINGS

- A. Drawing C-1, Piping Layout and Well Locations
- B. Drawing C-2, Compressor and Blower Plan and Profile
- C. Drawing P-1, Air Injection System P&ID
- D. Drawing M-1, Pipe Manifold and Well Head Details
- E. Drawing M-2, Well Head Extraction and Injection Well Head Details
- F. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 REFERENCES

- A. Materials ASTM D-3035
 ASTM D-1248
- B. Methods ASTM D-2837-88
 ASTM D-2657

1.5 SUBMITTAL

All manufacturer's O&M manuals, literature, and shop drawings shall be submitted to the Engineer for approval prior to installation of equipment listed in Section 2.

1.6 WARRANTY

A. Installation Warranty

The Contractor shall correct all defective work within a 1-year period of substantial completion.

B. Manufacturers Warranty

Provide a minimum of a 2-year manufacturer's warranty on all equipment and products specified for this section.

1.7 MAINTENANCE

Upon startup of the SVE and Air Sparging systems, the Contractor shall:

- A.** Provide all maintenance required for startup and operation of equipment installed under this section.
- B.** Provide manufacturer's recommended maintenance schedule for all equipment installed under this section.
- C.** Provide all maintenance materials, including routinely required spare parts, as recommended by the manufacturer for all equipment installed under this section.

1.8 QUALITY ASSURANCE

- A.** The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.
- B.** The Contractor shall seek products from a manufacturer specializing in the manufacture of items specified in this section.
- C.** The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 HEADER PIPING

- A. All piping shall be ASAHI Air-Pro HDPE pipe intended for compressed air application or the equivalent approved by the Engineer. In addition, the pipe shall be a dimensional ratio (SDR) pipe with wall Thickness to meet or exceed 230 psi at 86 F for piping through 4-inch nominal diameter. Two sizes will be required, 2-inch ID and 1.5-inch ID, as show on the Drawings.
- B. All fittings shall be HDPE intended for compressed air application. All fittings shall conform to the same requirements as the piping. They shall be of the correct size to construct the compressed air header, as shown on the Drawings.
- C. Threaded connections shall be provided at each well head and in the compressor building for connection of the related equipment, as shown on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall install all compressed air piping upon 6-inches of pipe bedding material as shown in the drawings.
- B. The Contractor shall ensure that the HDPE joints shall be socket fusion welded, or butt fusion welded.
- C. The Contractor shall snake the piping to allow for thermal contraction as the piping cools.
- D. The Contractor shall install the piping at a temperature no less than 50 F and no greater than 80 F.
- E. The Contractor shall install the piping in the wellhead enclosures as shown in the drawings. The surfaces of the knockouts in the enclosures shall be smooth, so the piping will not be scared by movement due to thermal expansion and contraction. The fittings for attachment of the compressed air injection well head equipment shall be at least 18-inches from the wall of the well head enclosure.
- F. The Contractor shall install the piping to compensate for thermal expansion or contraction of the piping.

3.2 DEMONSTRATION

- A. The Contractor shall evaluate the system after welding, but before burial. The compressed air injection header should be attached to a compressor, and with all openings capped off, the pressure should be raised in increments of 10 psi to 50 psi and checked for leaks. Each joint shall be checked using a soap solution that will bubble if a leak is present. The system should be allowed to equilibrate for one hour, then the pressure raised again to 50 psi. The pressure in the pipe should be monitored for two hours. If the pressure drops more than 10 percent (5 psi), the test has failed and must be repeated. The source of the leak must be identified and repaired or replaced at the discretion of the Engineer.
- B. The Contractor shall repeat the testing procedure in section 3.2 A. at 150 psi with an observation time of 12 hours. If the pressure drops more than 10 percent (15 psi), the test has failed and must be repeated. The source of the leak must be identified and repaired or replaced at the discretion of the Engineer.
- C. The Contractor shall backfill the piping system after the pressure testing described above, and with approval of the Engineer, it passes.

SECTION 15064 SVE PIPING MANIFOLD

PART 1 - GENERAL

1.1 DESCRIPTION

The SVE piping manifold will connect the vacuum source (two regenerative blowers) to each of the 13 extraction wells. The manifold will consist of 6- and 4-inch Schedule 80 PVC piping. The piping will be buried in a trench, with 6-inches of pipe bedding beneath and 6-inches of pipe bedding above the bottom of the pipe. The pipe will pass through each SVE well enclosure.

1.2 RELATED SECTIONS

- A. Section 02223 Pipe Bedding and Backfilling
- B. Section 02225 Trenching and Excavation
- C. Section 02605 Well Head Enclosures
- D. Section 15055 Soil Vapor Extraction Blowers
- E. Section 15061 Soil Vapor Extraction Well Heads

1.3 REFERENCE DRAWINGS

- A. Drawing C-1, Piping Layout and Well Locations
- B. Drawing P-2, SVE System and P&ID
- C. Drawing M-1, Pipe Manifold and Well Head Details
- D. Drawing M-2, Well Head Extraction and Injection Well Head Details
- E. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 REFERENCES

- Materials ASTM D-1784-65T
- Products ASTM D-1785

1.5 SUBMITTALS

All manufacturer's O&M manuals, literature, and shop drawings shall be submitted to the Engineer for approval prior to installation of equipment listed in Section 2.

1.6 WARRANTY

A. Installation Warranty

The Contractor shall correct all defective work within a 1-year period of substantial completion.

B. Manufacturers Warranty

The Contractor shall provide a minimum of a 2-year manufacturer's warranty on all equipment and products specified for this section.

1.7 MAINTENANCE

Upon startup of the SVE and Air Sparging systems, the Contractor shall:

- A. Provide all maintenance required for startup and operation of equipment installed under this section.**
- B. Provide manufacturer's recommended maintenance schedule for all equipment installed under this section.**
- C. Provide all maintenance materials, including routinely required spare parts, as recommended by the manufacturer for all equipment installed under this section.**

1.8 QUALITY ASSURANCE

- A. The Contractor shall use an adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.**
- B. The Contractor shall seek products for a manufacturer specializing in the manufacture of items specified in this section.**
- C. The Contractor shall comply with pertinent codes and regulations of governmental agencies having jurisdiction.**

PART 2 - PRODUCTS

2.1 PVC PIPING

- A. All piping shall be Schedule 80 PVC, and shall conform to ASTM D-1785.
- B. All fittings shall be the same wall thickness as the pipe. All fittings shall be uniformly fiberglass-reinforced where necessary.
- C. Threaded connections shall be provided at each well head and in the compressor building for connection of the related equipment, as shown on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall install all SVE piping upon 6-inches of pipe bedding material as shown in the drawings.
- B. The Contractor shall solvent weld the PVC joints.
- C. The Contractor shall the piping at a temperature no less than 50 F and no greater than 80 F.
- D. The Contractor shall the piping in the wellhead enclosures as shown in the drawings. The surfaces of the knockouts in the enclosures shall be smooth, so the piping will not be scared by movement due to thermal expansion and contraction. The fittings for attachment of the compressed air injection well head equipment shall be at least 18-inches from the wall of the well head enclosure.
- E. The Contractor shall the piping to compensate for thermal expansion or contraction of the piping.

3.2 DEMONSTRATION

- A. The Contractor shall evaluate the system after installation, but before burial. The SVE header should be attached to a compressor, and with all openings capped off, the pressure should be raised in increments of 5 psi to 25 psi and leak checked. Each joint shall be checked using a soap solution that will bubble if a leak is present. The system should be allowed to equilibrate for one hour, then the pressure raised again to 25 psi. The pressure in the pipe should be monitored for two hours. If the pressure drops more than 20 percent (5 psi), the test has failed and must be repeated. The source of the leak must be identified and repaired or replaced at the discretion of the Engineer.

- B. The Contractor shall backfill the piping system after the pressure testing described above, with approval of the Engineer it passes.

SECTION 16010 ELECTRICAL WORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Electrical work shall include: 1) electrical service to the system shed; 2) secondary power wiring and distribution system; 3) electrical control systems and interlock wiring; and 4) enclosure lighting and heating systems. Work performed will be in accordance with the standards listed below. Where these specifications are more stringent, they take precedence. In case of conflict, obtain a decision from the Engineer.
1. NFPA-70: National Electrical Code (current edition).
 2. NFPA-101: Life Safety Code (current edition).
 3. Illinois State Building Code (current edition).
 4. Applicable City Codes and Ordinances pertaining to electrical work.
 5. Applicable State of Illinois Code and Regulations.

1.2 RELATED SECTIONS

- A. Section 15054 Section Air Compressors and Appurtenances
- B. Section 15055 Soil Vapor Extraction Blowers
- C. Section 16109 Conduit Systems
- D. Section 16134 Control Panels and Motor Controllers
- E. Section 16421 Utility Service
- F. Section 16904 Programmable Logic Controller

1.3 REFERENCE DRAWINGS

- A. Drawing E-1, Electric Diagram
- B. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 SUBMITTALS

- A. The Contractor shall submit in reproducible form, shop drawings, material lists, and catalog cuts or manufacturer's printed data for major materials. Items that may be included are the following:
 - 1. Master Control Center/ Primary Logic Controller Wiring
 - 2. Panel boards and circuit protectors.
 - 3. Motor starters and contractors including custom wiring diagrams.
 - 4. Cable trays.
 - 5. Control panels.

1.5 WARRANTY

- A. The contractor shall verify that electrical equipment provided is compatible with the power supply available at the Site.
- B. The Contractor shall provide a 1-year warranty on all electrical work
- C. The Contractor shall provide a 2-year manufacture's warranty on all parts and equipment.

1.6 MAINTENANCE

The following are required:

- A. Operating and maintenance instructions for all electrical equipment.
- B. Any special equipment/materials needed during system startup.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contractor shall, unless otherwise indicated, provide all first quality, new materials and equipment free from any defects and suitable for the space provided. Provide materials and equipment listed by Underwriter's Laboratory or other qualified electrical testing laboratory where standards have be established by that agency.

- B. The Contractor shall provide the control panel with motor starters, alarms, LED indicators, programmable logic controllers, level controllers, solenoids, lighting and heating fixtures.

2.2 LIGHTING FIXTURES AND HEATERS

- A. The Contractor shall provide fixtures and heaters as shown on the drawings, and any material necessary for complete installation. Use only Underwriter's Laboratory (or other qualified electrical testing laboratory) listed equipment.
- B. Acceptable manufactures: Bryant, Culter-Hammer, General Electric, Gould I-T-E, Square D. Westinghouse, or Equivalent.
- C. Fixture/Heater Schedule:
 - 2 lamps (1 explosion proof) Ceiling Mount - 100 watts/ 120 volt
 - 2 heaters (1 explosion proof) Wall Mount - 3000 watts/ 240 volt
 - 2 thermostats (1 explosion proof)
- D. The Contractor shall use boxes and cover plates applicable for the location and hazardous atmosphere present in hazardous areas.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall obtain all necessary permits and inspection fees required for electrical installations prior to installation.
- B. The Contractor shall install all equipment in accordance with the design drawings.
- C. The Contractor shall install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. The Contractor shall provide work which has a neat and finished appearance.
- D. The Contractor shall check the approximate locations of light fixtures, equipment, and other electrical system components shown on Drawing for conflicts with openings structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, consult the Engineer. The Engineer's decision shall govern. Make modifications and changes as required.

3.2 DEMONSTRATION

- A. After completion of work, installation shall be completely operational and entirely free from ground, short circuits, and open circuits. The Contractor shall perform a thorough operational test in the presence of the Engineer. The Contractor shall furnish all labor, materials, and instruments for above tests.
- B. Prior to final observation and acceptance test, all electrical systems and equipment shall be in satisfactory operating condition, including, but not limited to the following:
 - 1. Electric motors for all equipment
 - 2. Programmable logic controller and associated equipment
 - 3. Controls
 - 4. Electric Heaters and Lighting

SECTION 16109 CONDUIT SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide a complete conduit system with associated couplings, connectors, and fittings.
- B. All work specified in this section shall comply with the provisions of Section 16010.

1.2 RELATED SECTIONS

- A. Section 15054 Section Air Compressors and Appurtenances
- B. Section 15055 Soil Vapor Extraction Blowers
- C. Section 16010 Electrical Work
- D. Section 16134 Control Panels and Motor Controllers
- E. Section 16421 Utility Service
- F. Section 16904 Programmable Logic Controller

1.3 REFERENCE DRAWINGS

- A. Drawing E-1, Electric Diagram
- B. Drawing M-3, SVE Blower and Air Injection Compressor Layout

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC)

Use PVC for:

- A. Service conduits for communication conductors
- B. Service conduits for electrical lines

- C. Conduct shall be explosion proof (EXP) where specified

2.2 FLEXIBLE CONDUIT

- A. The Contractor shall provide flexible conduit for the termination of equipment subject to motion and vibration.
- B. The Contractor shall ensure conduit is where exposed to continuous or intermittent moisture.
- C. The Contractor shall ensure that the flexible conduit is explosion proof (EXP) where specified.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. If above floor runs are required, the Contractor shall place conduit adjacent to air and water conducts if possible to maximize free space within the equipment rooms. Conduit shall be placed within walls or ceiling where appropriate.
- B. The Contractor shall ensure all conduit installation is in accordance with National Electric Code.
- C. The Contractor shall ensure that the minimum size of conduits 3/4-inch.
- D. The Contractor shall ensure that conduit joints, bends, or offsets are installed as appropriate.

3.2 PVC

Fittings shall be of the same material and manufacturer as the conduit.

SECTION 16134
CONTROL PANELS/ MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The equipment supplier shall provide a pre-wired control panel for the compressors.
- B. The contractor shall provide a control panel for the SVE blowers.
- C. The Contractor shall ensure all work specified in this section complies with the provisions of Section 16010.
- D. The Contractor shall provide electrical line voltage control components for blower motors.
- E. The Contractor shall wire and connect line voltage controls in working order in accordance with manufacturer's instructions.

1.2 RELATED SECTIONS

- A. Section 15054 Section Air Compressors and Appurtenances
- B. Section 15055 Soil Vapor Extraction Blowers
- C. Section 16010 Electrical Work
- D. Section 16109 Conduit Systems
- E. Section 16904 Programmable Logic Controller

1.3 REFERENCE DRAWINGS

- A. Drawing C-2, Compressor and Blower Plan and Profile
- B. Drawing E-1, Electric Diagram
- C. Drawing P-1, Air Injection System P&ID
- D. Drawing P-2, SVE System and P&ID

- E. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 SUBMITTALS

Submit product data as required by Section 16010.

PART 2 - PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

- A. The Equipment Supplier/Contractor shall provide control panel with prior approval from the Engineer.
- B. The Contractor shall supply motor starters as part of the pre-wired control panels.
- C. The Contractor shall ensure that the control panels are compatible with the system's primary logic controller (PLC). The control logic will consist at minimum of the following;
 - 1. Blower air flow alarm, will interlock off the blowers.
 - 2. SVE air flow alarm (high or low pressure) will interlock off (close solenoids) the air sparging supply lines after a timed delay.
 - 3. Vapor knockout pots alarm will interlock off blowers.
 - 4. Timed-off and timed-on capability.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall mount the control panel in a pre-engineered building consistent with manufacturer's instructions, the National Electric Code, and local standards.
- B. The Contractor shall connect all motors as indicated by manufacturer's instructions to associated starters. Actual conduit and conductor run lengths shall be determined for each location based on equipment locations as indicated on the site plans.

SECTION 16421 UTILITY SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall ensure that the metering equipment complies with ANSI/NFPA 70 - National Electrical Code.
- B. The Contractor shall ensure system characteristics are: 230/460 volts, 3 phase, 60 Hertz.
- C. The Contractor shall ensure that all work specified in this section shall comply with the provisions of Section 16010.

1.2 RELATED SECTIONS

- A. Section 15054 Section Air Compressors and Appurtenances
- B. Section 15055 Soil Vapor Extraction Blowers
- C. Section 16010 Electrical Work
- D. Section 16109 Conduit Systems
- E. Section 16134 Control Panels and Motor Controllers
- F. Section 16904 Programmable Logic Controller

1.3 REFERENCE DRAWINGS

- A. Drawing C-1, Piping Layout and Well Locations
- B. Drawing E-1, Electric Diagram
- C. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 WARRANTY

The Contractor shall perform Work in accordance with the Utility Company's written requirements.

PART 2 - PRODUCTS

2.1 UTILITY METER

The Contractor shall arrange for a meter to be supplied by Utility Company.

2.2 UTILITY METER BASE

The Contractor shall furnish the meter base and be approved by the State for a non-hazardous location.

2.3 RISER AND WEATHERHEAD

- A. The Contractor shall provide riser conduit and weatherhead of correct sizes and locations as directed by the local power and light company for service location.
- B. The Contractor shall provide conductors terminated at weatherhead of appropriate lengths required for electrical service hookup.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The owner will make arrangements with Utility Company to obtain permanent electric service to the Site.
- B. The Contractor shall coordinate the location of the Utility Company's facilities to ensure that proper access is available.
- C. The Contractor shall install a service rack and weatherhead at a height as required by the Utility Company. The Utility Company will connect service drop to service entrance conductors.
- D. The Contractor shall verify that the service equipment has been inspected and is ready to be connected and energized.

SECTION 16904
PROGRAMMABLE LOGIC CONTROLLER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Contractor shall install a programmable logic controller (PLC) to provide override control of the system components. The PLC will monitor the operation of the system and turn off the system if process control signals are out of preset ranges.
- B. The Contractor shall ensure that all work specified in this section complies with the provisions of Section 16010.

1.2 RELATED SECTIONS

- A. Section 15054 Section Air Compressors and Appurtenances
- B. Section 15055 Soil Vapor Extraction Blowers
- C. Section 16010 Electrical Work
- D. Section 16109 Conduit Systems
- E. Section 16134 Control Panels and Motor Controllers
- F. Section 16421 Utility Service

1.3 REFERENCE DRAWINGS

- A. Drawing E-1, Electric Diagram
- B. Drawing P-1, Air Injection System P&ID
- C. Drawing P-2, SVE System and P&ID
- D. Drawing M-3, SVE Blower and Air Injection Compressor Layout

1.4 SUBMITTALS

- A. The Contractor shall submit shop drawings indicating layout of completed assemblies, interconnecting cabling, and external power requirements.

- B. The Contractor shall submit manufacturer's installation instructions under provisions of Section 16010.

1.5 MAINTENANCE

- A. The Contractor shall submit copies of manufacture's warranty.
- B. The Contractor shall include copies of operating and programming instructions.

PART 2 - PRODUCTS

2.1 PROGRAMMABLE LOGIC CONTROLLER

- A. Owner shall supply a programmable logic controller and any associated relays to perform the following:
 - 1. Blower air flow alarm will interlock off the blowers.
 - 2. SVE air flow alarm (high or low pressure) will interlock off (close solenoids) the air sparging supply lines after a timed delay.
 - 3. Vapor knockout pots alarm will interlock off blowers.
 - 4. Timed-off and timed-on capability.

PART 3 - EXECUTION

- A. The Contractor shall verify that required utilities are available, in proper location, and ready for use.
- B. The Contractor shall install equipment in accordance with manufacturer's instructions.

3.1 DEMONSTRATION

- A. The Contractor shall provide a complete system demonstration and performance verification services.
- B. The Contractor shall demonstrate the operation and programming of controllers. Provide one 8-hour day of instruction for the operating person, to be conducted at the project site during system start-up.